Smartgen®

HGM7200/HGM7100 Series

AUTOMATIC GENSET CONTROL MODULE

User Manual

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Software Version

Date	Version	Note
2010-07-03	1.0	Original release
2010-12-15	1.1	Add note about some engine type. Correct some errors about selection of sensors.

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This manual is suitable for HGM7200 and HGM7100 series controller only.

SIGNS instruction

SIGN	INSTRUCTION
Note	This is reminding user to follow correct operation.
Careful	This is reminding that wrong operations could equipments damage.
Warning	This is reminding that wrong operations could cause death, serious personal injury, and property damage.

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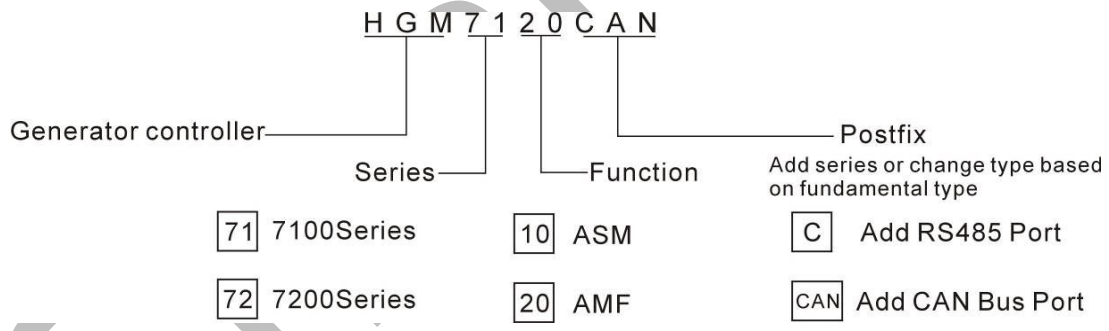
1 Summary

HGM7200/7100 series generator controller is integrating digital, intelligent and network techniques, used for automatic control system and monitor of diesel generator. It has functions of controlling genset start/stop automatic, data measuring, “remote controlling, remote measuring, remote communication” and protection alarm. The controller equip with bigger LCD display, Chinese and English option display. It is easy operation and reliable running.

HGM7200/7100 applies for microprocessor technique which can carry out precision measure, constant value adjustment, timing and threshold setting and etc. Most of parameters can be adjusted via panel of controller while all parameters also can be set, adjusted and monitored via PC by USB port or RS485 port. It can be widely used in all types of generator automatic control system for its compact structure, advanced circuits, simple connections and high reliability.

2 Order Information and Modules Comparison

2.1 Order Information



***Noted:**

(1) It is basic model if without postfix.

(2) ASM means Auto Start Module, AMF means Auto Mains Failure module.

2.2 Modules Comparison

TYPE	HGM 7220	HGM 7210	HGM 7120	HGM 7110	HGM 7120C	HGM 7110C	HGM 7120CAN	HGM 7110CAN
Numbers of digit input port	7	7	5	5	5	5	5	5
Numbers of relay output (1)	8	8	6	6	6	6	6	6
Numbers of sensors (2)	5	5	3	3	3	3	3	3

AMF	●		●		●		●	
RS485	●	●			●	●	●	●
GSM (SMS)	●	●						
CAN (J1939)							●	●
USB	●	●	●	●	●	●	●	●
Real-time clock	●	●						
Event log	●	●						

***Note:**

(1)Including of two fixed output ports, start output and fuel output.

(2)HGM7220/7210's analog sensors are composed by 3 fixed (temperature, pressure, fuel level) and 2 configurable sensors. Other controllers are composed by 3 fixed (temperature, pressure, liquid level) only.

2.3 Models abbreviation

Abbreviation	Description
HGM72X0	All HGM7200 series controller
HGM71X0	All HGM7100 series controller
HGM7X20	All HGM7200/7100 series AMF controller
HGM7X10	All HGM7200/7100 series ASM controller

3 Performance and Characteristics

HGM7X10, Auto Start Module, controls genset to start or stop automatic by remote start signal.

HGM7X20, Auto Main Failure, update based on HGM7X10. Special for automatic system made of 1 gens plus 1 mains.

Main characteristics,

- ♦ X32 ARM CPU used, high integration of hardware and more reliable;
- ♦ 132x64 LCD with backlit, Chinese, English or other languages display, gentle press button for operation;
- ♦ Acrylic materials used for protecting LCD screen, wear and scratch resistant performance is better;
- ♦ Silica gel panel and push buttons used more strong ability of adapting high-low temperature;
- ♦ Has RS485 communication port and "remote controlling, remote measuring, remote communication" functions by the ModBus protocol. (which controller has RS485 port only);

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- With SMS (Short Message Service) function. When genset is alarming, controller can send SMS automatic to max. 5 telephone numbers. User can control or check genets by sending Short Message (which controller has GSM port only);
- Has CANBUS port and can communicate with J1939 genset (which controller has CANBUS port only);
- Suitable for various system of 3-phase 4-wires, 3-phase 3-wires, 1-phase 2-wires, and 2-phase 3-wire (120/240v) power, 50/60HZ;
- Senses and shows gens or mains' 3-phase voltage, current, and power, frequency.

Parameters:

Mains	Gens
Line voltage (Uab, Ubc, and Uca)	Line voltage (Uab, Ubc, and Uca)
Phase voltage (Ua, Ub, and Uc)	Phase voltage (Ua, Ub, and Uc)
Phase sequence	Phase sequence
Frequency (F1)	Frequency (F2)

Load

Current IA, IB, IC

Each phase and total active power KW

Each phase and total inactive power KVar

Each phase and total apparent power KVA

Each phase and average power factor PF

Accumulate total gens power kWh, kVarh, kVAh

- For Mains, controller has over and under voltage, over and under frequency, loss and anti-phase functions; For gens, has over and under voltage, over and under frequency, loss and anti-phase, over and anti-power, over current functions;
- 3 fixed sensors (temperature, oil pressure and level);
- 2 configurable sensors can be set as sensor of temperature or fuel level (HGM72X0 has only);
- Precision measure and display parameters about Engine,

Temp. (WT)	°C/°F both be display
Oil pressure (OP)	kPa/Psi/Bar all be display
Fuel level (FL)	%
Speed (SPD)	RPM (unit)

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Voltage of Battery (VB) V (unit)

Voltage of Charger (VD) V (unit)

Hour count (HC) can accumulate Max. 65535 hours.

Starting up can accumulate Max. 65535times.

- ♦ Control protection, Start & Stop genset, ATS(Auto Transfer Switch) control automatic, and has complete failure protection function;
- ♦ All output ports are relay-out;
- ♦ User can modify parameters and store them in internal FLASH memory; the parameters setting cannot be missed even without power; most parameters can be set via panel of controller; and all parameters can be set via PC, which connected with USB or RS485;
- ♦ More kind of curves of temperature, pressure, fuel level can be used directly and users can define the sensor curve by themselves also;
- ♦ More successful start conditions (speed sensor, oil pressure, generator frequency) are optional;
- ♦ Widely power supply range (8~35VDC), accommodating to different battery voltage starting environments;
- ♦ HGM7200 series have functions of event logs, real-time clock, start & stop generator timing (can be set as start genset once a day/weekly/monthly whether with load or not);
- ♦ Can be used in pumping sets, and using as indicating meters also (indicating and alarming only, outputs is inactive);
- ♦ Have timing maintenance function. Actions (warning only or alarming stop) can be set when maintenance time up;
- ♦ All parameters used digital modulation and instead of analog modulation which using conventional electronic potentiometer. More reliability and stability;
- ♦ Modular design, anti-flaming ABS plastic shell, inserted type connection terminals and built-in mounting. Structure compact with easy mounting.

4 Specification

Items	Contents
Operating Voltage	DC8. 0V to 35. 0V, Continuous Power Supply.
Power Consumption	<3W (≤2W on waiting)
Alternator Input Range 3-Phase 4 Wire	15VAC - 360VAC (ph-N)

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3-Phase 3 Wire Single-Phase 2 Wire 2-Phase 3 Wire	30VAC - 620VAC (ph- ph) 15VAC - 360VAC (ph-N) 15VAC - 360VAC (ph-N)
Alternator Input Frequency	50/60Hz
Magnetic Input Range	1.0 V to 24.0 V (RMS)
Magnetic Input Frequency	10,000 Hz (max.)
Start Relay Output	16 Amp DC28V at supply output
Fuel Relay Output	16 Amp DC28V at supply output
Auxiliary Relay Output (1)	7 Amp DC28V at supply output
Auxiliary Relay Output (2)	7 Amp 250VAC voltage free output
Auxiliary Relay Output (3)	16 Amp 250VAC voltage free output
Auxiliary Relay Output (4)	16 Amp 250VAC voltage free output
Auxiliary Relay Output (5)	7 Amp DC28V at supply output (HGM72X0 only)
Auxiliary Relay Output (6)	7 Amp DC28V at supply output(HGM72X0 only)
Mounting Dimensions	197x152x47mm
Panel cutoff	186x141mm
C.T. Secondary	5A (rated)
Working conditions	Temperature: (-25~+70)°C; Humidity: (20~90)%
Storage Condition	Temperature: (-30~+80)°C
Protective Level	IP55: when waterproof rubber ring added between controller and its panel. IP42: when waterproof rubber ring not have between controller and its panel.
Insulation Intensity	Object: among in input/output/power Quote standard: IEC688-1992 Test way: AC1.5kV/1min 3mA leakage current
Net Weight	0.75kg

5 Operation

5.1 Key Functions

	Stop/Reset	Can stop generator and reset alarms; To test panel indicators are OK or not, pressing this key at least 3 seconds; During stopping process, press this again can stop

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		generator quickly.
	Start	To start genset in Manual mode or Manual Testing mode.
	Manual Mode	Pressing and controller enters Manual mode.
	Auto Mode	Pressing and controller enters Auto mode.
	Running with load	Pressing and controller enters Manual Testing mode.
	Reset of sound-off and alarming	Alarming sound off. If alarm of trip and not stop, long press 3 seconds can reset this alarm.
	Switching on and off of gens	Can control gens to breaker on or off in manual mode.
	Switching on and off of mains	Can control mains to switch on or off in manual mode (HGM7X10 without).
	Page turning & Confirmation	1. Pages turning; 2. Press 3 seconds and into basic parameters setting menu; shift cursor to confirm.
	Up/Increase	1. Screen pages turning; 2. Up cursor and Increase its position no. in setting menu.
	Down/Decrease	1. Screen pages turning; 2. Down cursor and Decrease its position no. in setting menu.

Note, press over 3 seconds, go into basic parameters setting menu.

Note, press simultaneously, go into senior parameters setting menu if enter correct passwords.

Note, press simultaneously, can increase contrast of LCD; press simultaneously, can decrease it. And the contrast of LCD will back default setting when controller have power again after lost.

Warning, default passport is 00318, in order to prevent others change the senior parameters setting, user can change it. Please closely remember it after changing. If you forget it, please contact Smartgen services and send all information in the controller page of “ABOUT”.

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5.2 LCD DISPLAY

5.2.1 Main display

Main display screen pages, for turning pages while for turning screen.

◙ Status, including as below,

Status of genset, mains, and ATS

◙ Engine, including as below,

Speed, temperature of engine, engine oil pressure, liquid (fuel) level, programmable Aux.1, programmable Aux.2, battery voltage, charger voltage, accumulated running time, accumulated starts times.

⚠ Note, if connected with J1939 engine via CANBUS port, this page still contains, coolant pressure, coolant level, fuel temperature, oil pressure, inlet and outlet port temperature, turbo pressure, total fuel consumption and so on.(different engine with different parameters)

◙ Gens, including as below,

Phase voltage, line voltage, frequency, phase sequence

◙ Mains, including as below

Phase voltage, line voltage, frequency, phase sequence

⚠ Note, HGM7X10 don’t have this page.

◙ Load, including as below,

Current, each phase and total active power (plus-minus), each phase and total inactive power (plus-minus), each phase and total apparent power, each phase and average power factor(plus-minus), accumulated energy (kWh, kVarh, kVAh).

Note, when only mains switch on and indicator light, count active and inactive power, apparent power, not accumulate electric energy. Counting the gens active and inactive power, apparent power, power factor, and accumulate electric energy under others condition.

⚠ Note, power factor shows as following,

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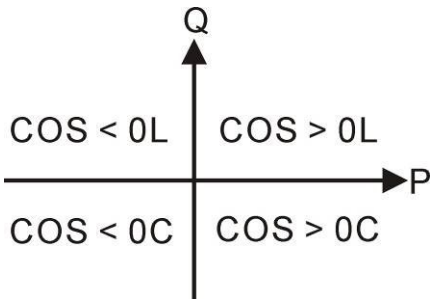

Remark:
P stands for active power
Q stands for inactive power

Power factor	Conditions	Active power	Inactive power	Remark
COS>0L	P>0,Q>0	Input	Input	Load is resistance inductive.
COS>0C	P>0,Q<0	Input	Output	Load is resistance capacitance.
COS<0L	P<0,Q>0	Output	Input	Load as one under excitation generator
COS<0C	P<0,Q<0	Output	Output	Load as one over excitation generator.

Remark,

1. Input active power, gens or mains on load.
2. Output active power, load send active power to gens or mains.
3. Input inactive power, gens or mains send inactive power to load.
4. Output inactive power, load send inactive power to gens or mains.

◙ Alarm

⚠ Note, instruction about ECU warning and alarming, if there is definite alarm and LCD will show details, please check the generator according to it; otherwise, please check the manual of generator according to SPN alarm code.

◙ Event log

Make records about all start/stop events (stop alarm, trip stop alarm, manual /auto start or stop) and its time.

⚠ Note, HGM71X0 without this page.

◙ Others, including,

Time and Date, count down time for maintenance, input/output ports status.

◙ About,

Release time of software and hardware versions.

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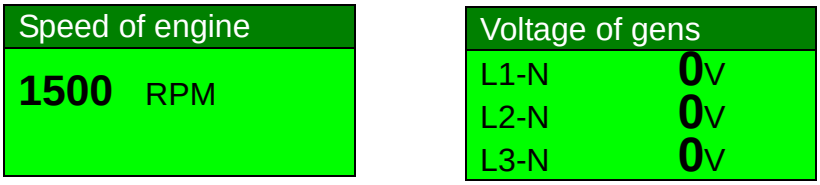
Example,



5.2.2 Basic parameters setting menu

Including as following,

- Conditions of successful start
- Number of engine teeth
- Rated speed
- Rated voltage of gens
- Rated frequency of gens
- Rated voltage of mains
- Rated frequency of mains
- Changing ratio of current transformer
- Rated current
- Rated power
- Voltage of battery
- Time and date
- Delay time of starting generator
- Delay time of stopping generator
- Preheat time
- Crank on time
- Crank Rest Time
- Safety on time
- Start idle time
- Warm up time
- Cooling time
- Stop idle time
- ETS(Energize to Stop) hold time
- Fail to stop time

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Example,

Basic Parameters Return Conditions of start No. of engine teeth Rated speed	Form 1: Change the items, into setting (form2), exit setting.

Conditions of start Setting 1 frequency + speed	Form 2: Into setting (Form3), press or to back previous men, back to previous menu (form 1).

Conditions of start 1 frequency + speed	Form 3: Change items; confirm setting (form2), exits setting (form2).

5.2.3 Advanced parameters setting menu

Including,

- Mains
- Timers
- Engine
- Generator
- Load
- ATS
- Analog Sensor
- Inputs
- Outputs
- Module
- Scheduled and maintenance
- GSM (SMS)

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Example

Advanced Parameters >mains >status delayed >engine >generator	Form1 Change items, enters setting (form2), exits setting.

Generator >return >AC supply mode >No. of poles >rated voltage	Form 2 Change items (form3), select “return” and press back to previous menu (form1), back to previous menu (form 1).

Generator >Under Voltage Shutdown > Over Freq Shutdown > Under Freq Shutdown > Over Voltage Warn	Form 3 Change items, confirm setting (form 4), back to previous menu (form 1).

Over Voltage Warn Sel: Disable Setting value, 00110% Return value : 00108% Delayed time: 00005	Form 4 Go into setting (form5), press or back to previous menu (form3), back to previous menu (form 3).

Over Voltage Warn Sel: Enable Setting value: 00110% Return value: 00108% Delayed time: 00005	Form 5 Change setting items (form 6), confirm setting (form 7), and exit setting (form4).

Over Voltage Warn Sel: Enable Setting value: 00110% Return value: 00108% Delayed time: 00005	Form 6 Change setting items (form5), confirm setting (form 7), and exit setting (form4).

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Gens over voltage warm Sel: Enable Setting value, 00110% Return value, 00108% Delayed time, 00005	Form 7 Change setting items (form5), confirm setting, and exit setting (form4).

Gens over voltage warning Sel: Disable Setting value, 00110% Return value, 00108% Delayed time, 00005	Form 8, Change setting items, confirm setting (form 4), and exit setting (form4).

Note: long time press can exit setting directly during setting.

5.3 Auto Start/Stop Operation

Press , its indicator light, controller enters Auto mode.

Sequence of Auto Start,

1. HGM7X20, When Mains is abnormal (over and under voltage, over and under frequency, miss phase, anti-phase), enters into mains “abnormal delay” and LCD display count down time. When mains abnormal are over, enter into “start delay”; also can be into this mode when “remote start on load” is active.
2. HGM7X10, generator enters into “start delay” as soon as “Remote Start on Load” is active.
3. Count down of “start delay” is shown in LCD.
4. When start delay is over, preheat relay is outputting (if this be configured), “preheat start delay XX s” is shown in LCD.
5. When preheat relay is over, fuel relay is outputting 1s and then start relay output; if engine crank fail during “cranking time”, the fuel and start relays stop outputting and enter into “crank rest time” and wait for next crank.
6. If generator crank fail within setting times, controller will send “Fail to start”.
7. Whatever ways to start generator successfully, it will enter into “safety on time”. During this period, alarms of low oil pressure, hi-temperature, under speed, charge fail are inactive. As soon as this delay is over, generator will enter into “start idle delay” (if this be configured).

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8. During “start idle delay”, alarms of under speed, under frequency, under voltage are inactive. As soon as this delay is over, generator will enter into “warming up time delay”; generator indicator is light if generator’s voltage, frequency is normal.
9. When “warming up time delay” is over, if generator’s voltage, frequency is normal, close gens relay will output. Generator will enter into normal running with load and gens close indicator is light; if generator’s voltage and frequency is abnormal, controller will alarm and stop engine (gens alarming is shown in controller’s alarm page).

Note, when start via “Remote Start (off Load)”, same procedure as above except for, gens switch on, relay not output and generator without load in NO.9.

Sequence of auto stop,

1. HGM7X20, when mains return during genset running, enters into mains voltage “Abnormal delay”. When mains abnormal delay are over, enter into “stop delay”; also can be into this mode when “remote start on load” is inactive.
2. HGM7X10, generator enters into “stop delay” as soon as “Remote Start on Load” is inactive.
3. When stop delay is over, close generator relay is un-energized; generator enters into “cooling time relay”. After “transfer rest time”, close mains relay is energized. Gens’ indicator dark while mains indicator is light.
4. Idle relay is energized as soon as entering “stop idle delay”.
5. If enters “ETS hold delay”, ETS relay is energized. Fuel relay’s output is broken.
6. Then enters genset “Fail to stop time”, auto decides whether generator is stopped or not.
7. Enters “over stop time” (if this is configured) as soon as generator stop. Otherwise, controller will send “Fail to stop” alarm. (If genset stopped successful after warning of “Failed to Stop”, will enter “over stop time” and remove alarm)
8. Enters “generator at rest” as soon as “over stop time” is over.

5.4 Manual start/stop operation

1. HGM7X20, Press , controller enters into Manual starts mode and its

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indicator light. Press , then controller enters into “Manual Test Mode” and its indicator light. In the both mode, press to start generator, can auto detect start successfully and generator auto accelerates to Hi-speed running. If there is Hi-temperature, low oil pressure and voltage abnormal during generator running, controller can protect genset to stop quickly (detail procedures please refer to No.4~9 of Auto start operation). In “Manual Test Mode “, generator runs well, whether mains are normal or not, loading switch must be transferred to generator side. In “manual mode “, the procedures of ATS please refer to ATS procedure of generator in this manual.

2. HGM7X10, Press , controller enters into Manual starts mode and its indicator light. Then press to start generator, can auto detect start successfully and generator auto accelerates to Hi-speed running. If there is Hi-temperature, low oil pressure and voltage abnormal during generator running, controller can protect genset to stop quickly (detail procedures please refer to No.4~9 of Auto start operation). After generator runs well, if remote start signal is active, controller will send closing gens; if the remote signal is inactive, controller won’t send closing signal.
3. Manual stop, press can shutdown the running generator (detail procedures please refer to No.3~8 of Auto stop operation).

5.5 Switch control procedures

5.5.1 HGM7X20 Switch control procedures

Manual transfer procedures

When controller is in Manual mode, the switch control procedures will start through manual transfer.

Users can control the loading transfer of ATS via pressing button to switch on or off.

A. If “Open breaker check” detect is “SELECT disable”

Press gens switch on or off key , if gens has taken load, will output unload

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signal; if taken no load, gens will output load signal; if mains has taken load, mains will unload, and then gens will take load.

Press mains switch on or off key

, if mains has taken load, will output unload signal; if taken no load, mains will output load signal; if gens has taken load, gens will unload, and then mains will take load.

B. If "Open breaker check" detect is "SELECT enable"

If transfer load from mains to gens, need to press mains switch off key

firstly.

Then, after switch off delay, press gens switch on key

, and gens will take load (it is no action when press key of gens switch on directly).

The way that from gens to mains is as same as above.

Auto transfer procedures:

When controller is in Manual Test, Auto or Stop mode, switch control procedures will start through automatic transfer.

1. If configurable input port is connected with closing breaker signal

A. If "Open breaker check" detect is "SELECT disable"

When transferring load from Mains to gens, controller begin detecting "fail to transfer", then the open delay and transfer rest delay will begin. After detecting time up, if switch open fail, the gens will not switch on, otherwise, gens switch on. Detecting transfer fail while gens switch on. After detecting time up, if switch on fail, to wait for gens switch on. If transfer fail and warning "SELECT enable", there is alarming signal whatever switch on or off failure.

The way that gens load be transferred into mains load as same as above.

B. If "Open breaker check" detect is "SELECT disable"

Mains load be transferred into gens load, after the delay of switch off and transfer interval, gens switch on. Detecting transfer fail while gens switch on. After detecting time up, if switch on fail, then wait for gens switch on. If transfer fail and warning "SEL enable", there is alarming signal.

2. If input port is not connected with closing breaker input

Mains load be transferred into gens load, after switch off and transfer interval delay, gens switch on.

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The way that gens load be transferred into mains load as same as above.

5.5.2 HGM7X10 Switch control procedures

Manual transfer procedures

When controller is in Manual mode, switch control procedures will start through manual transfer.

Users can control switch on or off via press key.

Press gens switch on or off key C/O, if gens have taken load, will output unload signal; if taken no load, gens will output load signal.

Auto control procedures,

When controller is in manual test, auto or stop mode, switch control procedures will start auto transfer.

1. If configurable input port is connected with closing breaker signal

A. If "Open breaker check" detect is "SELECT disable"

Gens load be transferred into gens un-load, after the delay of switch off, detecting transfer fail while switch off output. After detecting time up, if switch off fail, to wait for switch off. Otherwise, switch off is completely.

Gens un-load be transferred into gens load, after the delay of switch on, detecting transfer fail while switch on output. After detecting time up, if switch on fail, to wait for switch on. Otherwise, switch on is completely.

If transfer fail and warning "SEL enable", there is alarming signal whatever switch on or off failure.

B. If "Open breaker check" detect is "SELECT enable"

Gens load be transferred into gens un-load, after the delay of switch off, switch off is completely.

Gens un-load be transferred into gens load, after the delay of switch on, detecting transfer fail while switch on output. After detecting time up, if switch on fail, to wait for switch on. Otherwise, switch on is completely.

If transfer fails warning is "SEL enable", there is warning signal that "switch on fail".

2. If configurable input port is connected with closing breaker signal

Gens un-load is transferred into gens load, gens switch on and output.

Gens load is transferred into gens un-load, gens switch off and output.

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Note,

When use ATS of no interposition, should select switch off detecting is “SELECT disable”;

When use ATS of having interposition, switch off detecting is “SELECT disable” or “SELECT enable” are both OK. If choose detecting is “SELECT enable”, please set the output of switch off;

When use AC contactor, recommend choosing switch off detecting is “SELECT disable”.

6 Protection

6.1 Warning

When controller detects the warning signal, only alarm and not stop genset.

Warnings as following,

No.	Type	Description
1	Over speed	When controller detected the speed of genset is over the threshold of over speed setting.
2	Under speed	When controller detected the speed of genset is under the threshold of under speed setting.
3	Loss of speed	When controller detected the speed of genset is 0 and speed signal lost type.
4	Over Frequency	When controller detected the frequency of genset is over the threshold of over frequency setting.
5	Under Frequency	When controller detected the frequency of genset is under the threshold of under frequency setting.
6	Over Voltage	When controller detected the voltage of genset is over the threshold of over voltage setting.
7	Under Voltage	When controller detected the voltage of genset is under the threshold of under voltage setting.
8	Over Current	When controller detected the current of genset is over the threshold of over current setting.
9	Failed To Stop	When generator not stops after the “stop relay” is over.
10	Charge Alt Fail	When controller detected the charge voltage of genset is under the threshold of setting.
11	Battery High Voltage	When controller detected the battery voltage of genset is over the threshold of setting.

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No.	Type	Description
12	Battery Low Voltage	When controller detected the battery voltage of genset is under the threshold of setting.
13	Maintenance Over Time	When count down time is 0 and select the" Maintenance Over Time" setting.
14	Reverse Power	When controller detected the value reverse power (power is minus) of genset is over the threshold of setting.
15	Over Power	When controller detected the value reverse power (power is positive) of genset is over the threshold of setting.
16	ECU warning	When controller gets the alarm signal from engine via J1939.
17	Gens Loss Of Phase	When controller detected the gens loss phase.
18	Gens Reverse Phase Sequence	When controller detected the gens Reverse Phase.
19	Switch Transfer Fail Warn	When controller detected the switch on and off fail, and switch transfer select enable.
20	Temperature Sensor Open Circuit	When controller detected the sensor is open circuit, and select warning of open circuit.
21	High Temperature Warn	When controller detected the temperature of genset is over the threshold of setting.
22	Low Temperature Warn	When controller detected the temperature of genset is under the threshold of setting.
23	Pressure Sensor Open Circuit	When controller detected the sensor is open circuit, and select warning of open circuit.
24	Low OP Warn	When controller detected the oil pressure is under the threshold of setting.
25	Level Sensor Open Circuit	When controller detected the oil lever sensor is under the threshold of setting.
26	Low Level Warn	When controller detected the oil lever sensor is over the threshold of setting.
27	Programmable Sensor 1 Open Circuit	When controller detected the sensor is open circuit, and select warning of open circuit.
28	Programmable Sensor 1 High	When controller detected the sensor No. is over the threshold of setting.
29	Programmable Sensor 1 Low	When controller detected the sensor No. is under the threshold of setting.
30	Programmable Sensor 2 Open Circuit	When controller detected the sensor is open circuit, and select warning of open circuit.
31	Programmable Sensor 2 High	When controller detected the sensor No. is over the threshold of setting.

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No.	Type	Description
32	Programmable Sensor 2 Low	When controller detected the sensor No. is under the threshold of setting.
33	Aux Input Warn	When digit input port programmable as warning and is active, controller sending corresponding warning signal.
34	GSM Com Fail	When select GSM enable and can't detect GSM model.

6.2 Shutdown Alarm

When controller detected shutdown alarm, it will send signal to switch off gens and to shutdown.

Shutdown alarms as following,

No.	Type	Description
1	Emergency shutdown	When controller detected emergency stop signal, it will send a stop alarm signal
2	Over Speed Shutdown	When controller detected over speed value, it will send a stop alarm signal
3	Under Speed Shutdown	When controller detected under speed value, it will send a stop alarm signal
4	Loss Of Speed	When controller detected speed value equals 0, and speed signal is lost, it will send a stop alarm signal
5	Gens Over Frequency	When controller detected genset's frequency is over value of setting for stop, it will send a stop alarm signal
6	Gens Under Frequency	When controller detected genset's frequency is under value of setting for stop, it will send a stop alarm signal
7	Gens Over Voltage	When controller detected genset's voltage is over value of setting for stop, it will send a stop alarm signal
8	Gens Under Voltage	When controller detected genset's voltage is under value of setting for stop, it will send a stop alarm signal
9	Failed To Start	If genset start fail within setting of start times, controller will send a stop alarm signal
10	Over Current	When controller detected genset's current is under value of setting, and over-current alarm is set, it will send a stop alarm signal.

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No.	Type	Description
11	Maintenance Over Time	When count down time is 0 and select the" Maintenance Over Time" is set, it will send a stop alarm signal.
12	ECU Alarm	When controller gets stop alarm from engine via J1939, it will send a stop alarm signal.
13	ECU Com Fail Shutdown	When controller not gets data from engine via J1939, it will send a stop alarm signal.
14	Reverse Power Shutdown	When controller detected genset's reverse power value (power is negative) is over value of setting, and the reverse power action alarm is set, it will send a stop alarm signal.
15	Over Power Shutdown	When controller detected genset's reverse power value (power is positive) is greater than value of setting, and the reverse power action alarm is set, it will send a stop alarm signal
16	Temperature Sensor Open Circuit	When controller detected sensor is open circuit, and this alarm is set, it will send a shutdown alarm signal
17	High Temperature Shutdown	When controller detected temperature is higher than set for alarming, it will send a shutdown alarm signal
18	Pressure Sensor Open Circuit	When controller detected sensor is open circuit, and this alarm is set, it will send a shutdown alarm signal
19	Low OP Shutdown	When controller detected oil pressure is under than set for alarming, it will send a shutdown alarm signal
20	Level Sensor Open Circuit	When controller detected sensor is open circuit, and this alarm is set, it will send a shutdown alarm signal
21	Programmable Sensor 1 Open Circuit	When controller detected sensor is open circuit, and this alarm is set, it will send a shutdown alarm signal
22	Programmable Sensor 1 High	When controller detected sensor value is over than upper limit alarm, and this alarm is set, it will send a shutdown alarm signal
23	Programmable Sensor 1 Low	When controller detected sensor value is under than lower limit alarm, and this alarm is set, it will send a shutdown alarm signal
24	Programmable Sensor 2 Open Circuit	When controller detected sensor is open circuit, and this alarm is set, it will send a shutdown alarm signal

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No.	Type	Description
25	Programmable Sensor 2 High	When controller detected sensor value is over than upper limit alarm, and this alarm is set, it will send a shutdown alarm signal
26	Programmable Sensor 2 Low	When controller detected sensor value is under than lower limit alarm, and this alarm is set, it will send a shutdown alarm signal
27	Aux Input Shutdown	When switch value port is set as shutdown alarm, and the alarm is active, it will send a shutdown alarm signal

6.3 Trip and shutdown alarm

When controller detected shutdown alarm signal, it will shutdown gens quickly and after hi-speed cooling to stop.

Trips stop alarm as following,

No.	Type	Description
1	Over current	When controller detected genset's current is over setting and over current trip stop is set, it will send a trip stop alarm signal
2	Maintenance Over Time	When count down time is 0 and the" Maintenance Over Time" is set, it will send a trip stop alarm signal
3	Reverse power	When controller detected genset's reverse power value (power is negative) is over value of setting, and the reverse power action trip alarm is set, it will send a trip stop alarm signal.
4	Over power	When controller detected genset's reverse power value (power is positive) is greater than value of setting, and the reverse power action trip alarm is set, it will send a trip stop alarm signal.
5	Aux. Input ports	When input port is set as trip stop alarm, and the alarm is active, it will send a trip stop alarm signal

6.4 Trip and not shutdown alarm

When controller detected stop alarm, it wills breaker signal of gens switch on quickly, but genset not stop.

Trip and not stop alarm as following,

No.	Type	Description
1	Over current	When controller detected genset's current is over setting and over current "trip and not stop" is set, it will send a trip and not stop alarm signal

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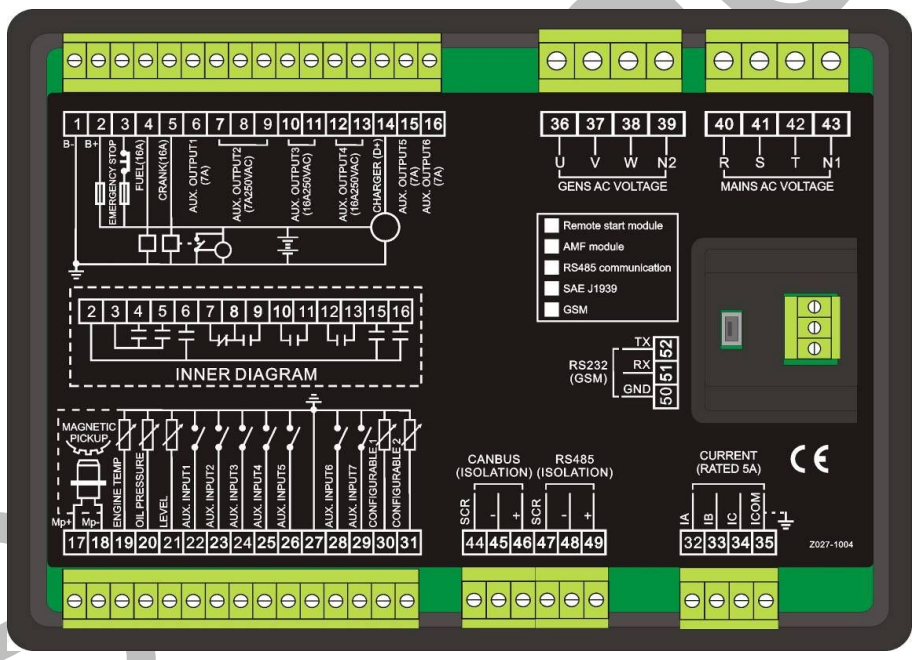
No.	Type	Description
2	Reverse power	When controller detected genset's reverse power value (power is negative) is over value of setting, and the reverse power action trip alarm is set, it will send a "trip and not stop" alarm signal.
3	Over power	When controller detected genset's reverse power value (power is positive) is greater than value of setting, and the reverse power action trip alarm is set, it will send a "trip and not stop" alarm signal.
4	Input ports	When input port is set as trip stop alarm, and the alarm is active, it will send a "trip and not stop" alarm signal.

7 Wirings connection

HGM7200/7100 series controller backside.



Description of terminal connection

Serial	Functions	Diameter	Remark
1	DC input -Ve	2.5mm	Connected to negative of starter battery
2	DC input +Ve	2.5mm	Connected to positive of starter battery. If wire length is over 30m, better to double wires in parallel. Max. 20A fuse recommended.
3	Emergency stop input	2.5mm	Connected to +Ve via emergency stop button
4	Fuel Relay output	1.5mm	+Ve is supplied by 3 points, rated 16A

Serial	Functions	Diameter	Remark	
5	Start Relay output	1.5mm	+Ve is supplied by 3 points, rated 16A	Connected to coil of starter
6	Programmable Relay output port 1	1.5mm	+Ve is supplied by 2 points, rated 7A	Details see Form 2
7	Programmable Relay output port 2	1.5mm	Normal close outputs, rated 7A	
8			Public points of relay	
9			Normal open outputs, rated 7A	
10	Programmable Relay output port 3	2.5mm	Normal open passive contacts of relay, rated 16A,output of passive contacts	
11				
12	Programmable Relay output port 4	2.5mm		
13				
14	Charge generator D+ port input	1.0mm	Connected to charging starter's D+ (WL) terminals. If there is no this terminal, and be hung up.	
15	Programmable Relay output port 5	1.5mm	+Ve supplied by 2 points, rated 7A(HGM7100 series without)	Details see form 2
16	Programmable Relay output port 6	1.5mm		
17	Magnetic Pickup input	Connected to Magnetic Pickup, shielding line is recommended		
18	Magnetic Pickup input, and controller inner be connected to battery negative.			
19	Temperature sensor input	Connected to temp. sensor		Setting items see form 4
20	Oil pressure sensor input	Connected to oil pressure sensor		
21	Oil level sensor input	Connected to oil level sensor		
22	Programmable input port 1	1.0mm	Ground connected is active (- Ve)	Setting items see form 3
23	Programmable input port 2	1.0mm		
24	Programmable input port 3	1.0mm		
25	Programmable input port 4	1.0mm		
26	Programmable input port 5	1.0mm		

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Serial	Functions	Diameter	Remark	
27	Public terminals of sensor	Public terminals of sensor, controller inner are connected to battery negative.		
28	Programmable input port 6	1.0mm	Ground connected is active (-Ve) (HGM7100series without)	Setting items see form 3
29	Programmable input port 7	1.0mm		
30	Programmable sensor 1	Connected to temperature, oil pressure or fuel level sensors (HGM7100 series without)		Setting items see form 4
31	Programmable sensor 2			
32	Current transformer A-phase monitoring input	1.5mm	Outside connected to secondary coil of current transformer(rated 5A)	
33	Current transformer B-phase monitoring input	1.5mm	Outside connected to secondary coil of current transformer(rated 5A)	
34	Current transformer C-phase monitoring input	1.5mm	Outside connected to secondary coil of current transformer(rated 5A)	
35	Public terminals of current transformer	1.5mm	See following installation instruction	
36	Genset A-phase voltage monitoring input	1.0mm	Connected to A-phase output of genset (2A fuse is recommended)	
37	Genset B-phase voltage monitoring input	1.0mm	Connected to B-phase output of genset (2A fuse is recommended)	
38	Genset C-phase voltage monitoring input	1.0mm	Connected to C-phase output of genset (2A fuse is recommended)	
39	Genset N-line input	1.0mm	Connected to output N-line of genset	
40	Mains A-phase voltage monitoring input	1.0mm	Connected to A-phase of mains (2A fuse is recommended) (HGM7X10 without)	
41	Mains B-phase voltage monitoring input	1.0mm	Connected to B-phase of mains (2A fuse is recommended) (HGM7X10 without)	
42	Mains C-phase voltage monitoring input	1.0mm	Connected to C-phase of mains (2A fuse is recommended) (HGM7X10 without)	
43	Mains N-line input	1.0mm	Connected to output N-line of mains (HGM7X10 without)	
44	CAN Screen		Impedance-120Ω shielding line is	

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Serial	Functions	Diameter	Remark
45	CAN-	0.5mm	recommended, its single-end earthed (controller without CANBUS function don't have this terminal)
46	CAN+	0.5mm	
47	RS485 Screen		Impedance-120Ω shielding line is recommended, its single-end earthed (controller without RS485 don't have this terminal)
48	RS485-	0.5mm	
49	RS485+	0.5mm	
50	RS232 GND	0.5mm	Connected to GSM module (HGM7100 series without)
51	RS232 RX	0.5mm	
52	RS232 TX	0.5mm	

Note, USB ports in controller back are programmable parameter, user can directly program controller via PC.

Note, please refer to the model No. in this manual for comparison and learn products' functions.

8 Scopes and definitions of programmable parameters

HGM7200/7100 series controller's programmable parameters can be set as following.

8.1 Contents and scopes of parameters form (form 1)

No.	Items	Parameters	Defaults	Description
Mains setting				
1	Mains AC supply system	(0-3)	0	0: 3P4L; 1: 3P3L; 2: 2P3L; 3: 1P2L.
2	Mains rated voltage	(30-30000)V	230	Offer standards for checking mains over/under voltage. If using voltage transformer, this value is initial voltage of transformer.
3	Mains rated frequency	(10.0-75.0)Hz	50.0	Offer standards for checking mains over/under frequency.

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No.	Items	Parameters	Defaults	Description
4	Mains normal delay	(0-3600)S	10	The time when mains changed from abnormal to normal.
5	Mains abnormal delay	(0-3600)S	5	The time when mains changed from normal to abnormal.
6	Mains voltage transformer	(0-1)	0	0: Disable ; 1: Enable
7	Setting of mains over voltage	(0-1000)%	120	Setting value is mains rated voltage's percentage, and return or delay values also can be set.
8	Setting of mains under voltage	(0-1000)%	80	
9	Setting of mains over frequency	(0-1000)%	114	Setting value is mains rated frequency's percentage, and return or delay values also can be set.
10	Setting of mains under frequency	(0-1000)%	90	
11	Monitor mains miss-phase	(0-1)	1	0: Disable; 1: Enable
12	Monitor mains anti-phase	(0-1)	1	
Timer setting				
1	Start delay	(0-3600)S	1	Time from mains abnormal or remote start signal is active to genset start.
2	Stop delay	(0-3600)S	1	Time from mains normal or remote start signal is inactive to genset stop.
3	Preheat time	(0-3600)S	0	Time of heat plug is pre-power up before starter is power up.
4	Crank time	(3-60)S	8	Time of starter power up each time.
5	Crank Rest time	(3-60)S	10	The second waiting time before power up when engine start fail.

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No.	Items	Parameters	Defaults	Description
6	Safety on time	(1-60)S	10	During this period, low oil pressure, high temperature, under speed, under frequency, under voltage, charging failed alarms are all inhabitable.
7	Start idle time	(0-3600)S	0	Idle running time of genset when starting.
8	Warm up time	(0-3600)S	10	Warming time before genset switch on, after it into high speed running.
9	Coolant time	(0-3600)S	10	Radiating time before genset stop, after it unloads.
10	Stop idle time	(0-3600)S	0	Idle running time when genset stop.
11	Energized to Stop (ETS) time	(0-3600)S	20	Stop electromagnet's power on time when genset is stopping.
12	Fail to Stop time	(0-3600)S	0	Time from over of idle delay to stopped when "ETS (Energized to Stop) time" is set as 0; Time from over of ETS hold delay to stopped when "ETS Hold output time" is not equal 0.
13	Genset Over Stop time	(0-3600)S	0	Time from genset stopped to standby
Engine setting				
1	Engine type	(0-39)	0	Default, common genset (not J1939). When connected to J1939 engine, choose the correspond type.
2	Tooth number of engine	(10-300)	118	Tooth number of the engine, for judging of starter separation conditions and inspecting of engine speed. See installation instruction as following.

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No.	Items	Parameters	Defaults	Description
3	Engine rated speed	(0-6000)RPM	1500	For offer standards to judge of over speed, under speed and loading speed.
4	Loading speed	(0-100)%	90	Setting value is percentage of rated speed. Controller detects when will load. Won't switch on when speed is under loading speed.
5	Loss of Speed delay	(0-3600)S	5	Time that detecting speed is 0 and confirm the actions.
6	Loss of Speed action	(0-1)	0	0:alarm; 1:alarming and stop
7	Over Speed Shutdown setting	(0-200)%	114	Setting value is percentage of rated speed and delay value also can be set.
8	Under Speed Shutdown setting	(0-200)%	80	
9	Over Speed Warn setting	(0-200)%	110	Setting value is percentage of rated speed and delay & return values also can be set.
10	Under Speed Warn setting	(0-200)%	86	
11	Rated voltage of battery	(0-60.0)V	24.0	To offer standards for detecting of over/under voltage of battery.
12	High voltage of battery Warn	(0-200)%	120	Setting value is percentage of rated voltage of battery and delay & return values also can be set.
13	Lower voltage of battery Warn	(0-200)%	85	
14	Charging failed Warn	(0-60.0)V	8.0	When genset in normal running, when charger voltage D+ (WL) is under this value, controller will send alarm of charging failed.
15	Crank times	(1-10) times	3	Max. Crank times when engine start failed. When reach this number, controller will send signal of start failed.

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No.	Items	Parameters	Defaults	Description
16	Start successfully conditions	(0-6)	2	See form 5. There are 3 conditions when starter is separated with engine. Each condition can be used lonely and simultaneously. In order to make the motor is separated with starter immediately.
17	Frequency when engine start successfully	(0-200)%	24	Setting value is percentage of gens rated frequency. When gens frequency is over than setting, starter will be separated. See installation manual as following.
18	Speed when engine start successfully	(0-200)%	24	Setting value is percentage of rated rotate speed. When gens rotate speed is over than setting, starter will be disconnected. See installation manual as following.
19	Oil pressure when engine start successfully	(0-1000)kPa	200	When oil pressure is over than setting, starter will be disconnected. See installation manual as following.
Generator setting				
1	Gens AC supply system	(0-3)	0	0: 3P4L; 1: 3P3L; 2: 2P3L; 3: 1P2L.
2	Generator pole number	(2-16)	4	Numbers of generator pole, this value can be calculated as starters rotate speed to the engines which don't have magnetic pickup.

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No.	Items	Parameters	Defaults	Description
3	Gens rated voltage	(30-30000)V	230	To offer standards for detecting of gens' over/under voltage and loading voltage. If using voltage transformer, this value is first voltage of transformer.
4	Loading voltage	(0-200)%	85	Setting value is percentage of gens rated voltage. When gens voltage is under loading voltage, won't enter into normally running, during the period of when controller ready to detect loading.
5	Gens rated frequency	(10.0-75.0)Hz	50.0	To offer standards for detecting of over/under frequency and loading frequency.
6	Loading frequency	(0-200)%	85	Setting value is percentage of gens rated frequency. When gens frequency is under loading frequency, won't enter into normally running, during the period of when controller ready to detect loading.
7	Gens voltage transformer	(0-1)	0	0: Disable; 1: Enable
8	Gens over voltage shutdown	(0-200)%	120	Setting value is percentage of gens rated voltage. Delay value also can be set.
9	Gens under voltage shutdown	(0-200)%	80	
10	Gens over frequency shutdown	(0-200)%	114	Setting value is percentage of gens rated frequency. Delay value also can be set.
11	Gens under frequency shutdown	(0-200)%	80	

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No.	Items	Parameters	Defaults	Description
12	Gens over voltage warn	(0-200)%	110	Setting value is percentage of gens rated voltage. Delay and return value also can be set.
13	Gens under voltage warn	(0-200)%	84	
14	Gens over frequency warn	(0-200)%	110	Setting value is percentage of gens rated frequency. Delay and return value also can be set.
15	Gens under frequency warn	(0-200)%	84	
16	Gens miss phase monitor	(0-1)	1	0: Disable 1: Enable
17	Gens anti-phase monitor	(0-1)	1	
Load setting				
1	Current transformer (CT)	(5-6000)/5	500	Outside connected to current ratio of transformation.
2	Rated full-load current	(5-6000)A	500	Means generator's rated current, used to as standards of load current.
3	Rated power	(0-6000)kW	276	Means generator's rated power, used to as standards of load current.
4	Overload current	(0-200)%	120	Setting value is percentage of gens rated voltage. Delay value also can be set to fixed time-lag or inverse time lag.
5	Over power	(0-1)	0	0: Disable 1: Enable.
6	Anti-power	(0-1)	0	0: Disable 1: Enable.
Switch setting				
1	Switch transfer rest time	(0-7200)S	5	Interval time from mains switch off to gens switch on; or from gens switch off to mains switch on.

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No.	Items	Parameters	Defaults	Description
2	Switch on delay time	(0-20.0)S	5.0	Pulse width of mains/gens switch on. When it is 0, means output constantly.
3	Switch off delay time	(0-20.0)S	3.0	Pulse width of mains/gens switch off.
4	Switch transfer detecting delay	(0-20.0)S	5.0	Detecting time of switch auxiliary contacts, after it is transferred.
5	Transfer failed warning “Enable”	(0-1)	0	0: Disable 1: Enable.
6	Switch off detecting “Enable”	(0-1)	0	
Module setting				
1	Work mode when power on	(0-2)	0	0:Stop mode 1:Manual mode 2:Auto mode
2	Communication address	(1-254)	1	Controller’s address when remote is monitored.
3	Number of stop bit	(0-1)	0	0: 2 stop bits; 1: 1 stop bit
4	Language select	(0-2)	0	0: Simplified Chinese 1: English 2: Others
5	Password	(0-65535)	00318	Used to enter into advanced parameters setting.
GSM setting				
1	GSM Enable	(0-1)	0	0: Disable; 1: Enable
2	Phone number	Max.20 digits		The phone no. must be added its national and area’s cods. Example, Chinese phone, 8613666666666.
Timing start and maintenance setting				
1	Timing start generator	(0-1)	0	0: Disable; 1: Enable
2	Timing not start generator	(0-1)	0	0: Disable; 1: Enable

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No.	Items	Parameters	Defaults	Description
3	Maintenance	(0-1)	0	0: Disable; 1: Enable
Analog sensors setting				
Temperature sensors				
1	Type of curve	(0-15)	7	SGX Details in Form 5
2	Open circuit action	(0-2)	0	0: warn; 1: shutdown; 2: no action
3	Hi-temperature shutdown	(-50-+300)ºC	98	When temperature of outside connected sensor is over this value, sending Hi-temperature shutdown warning. This value is be detected only after safety delay is over. The delay value also can be set.
4	Hi-temperature warning	(-50-+300)ºC	95	When temperature of outside connected sensor is over this value, sending Hi-temperature warning. This value is be detected only after safety delay is over. The delay and return value also can be set.
5	Low-temperature warning	(0-1)	0	0: Disable; 1: Enable
Oil pressure sensors				
1	Type of curve	(0-15)	7	SGX Details in Form 5
2	Open circuit action	(0-2)	0	0: warning 1: shutdown 2: no action

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No.	Items	Parameters	Defaults	Description
3	Low-pressure shutdown	(0-1000)kPa	103	When pressure of outside connected sensor is over this value, sending Low-pressure shutdown warning. This value is be detected only after safety delay is over. The delay value also can be set.
4	Low-pressure warning	(0-1000)kPa	124	When pressure of outside connected sensor is over this value, sending Low-pressure warning. This value is be detected only after safety delay is over. The delay and return value also can be set.
Liquid level sensors				
1	Type of curve	(0-15)	4	SGH Details in Form 5
2	Open circuit action	(0-2)	0	0:warning; 1:shutdown; 2:no action
3	Low-level warning	(0-300)%	10	When level of outside connected sensor is lower than this value, sending Low-level warning. This value is be detected all the time. The delay and return value also can be set.
Programmable sensor 1				
1	Programmable sensor 1 setting	(0-1)	0	0: Disable 1: Enable This can be set as temperature, pressure and liquid lever sensor.
Programmable sensor 2				

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No.	Items	Parameters	Defaults	Description
1	Programmable sensor 2setting	(0-1)	0	0: Disable 1: Enable This can be set as temperature, pressure and liquid lever sensor.
Programmable input port				
Programmable input port 1				
1	Contents setting	(0-50)	28	Remote start (with load). Details in Form 3
2	Active type	(0-1)	0	0: closing is active 1: opening is active
Programmable input port 2				
1	Contents setting	(0-50)	26	Hi-temperature Shutdown input
2	Active type	(0-1)	0	Same as above
Programmable input port 3				
1	Contents setting	(0-50)	27	Low oil pressure Shutdown input. Details in form 3
2	Active type	(0-1)	0	Same as above
Programmable input port 4				
1	Contents setting	(0-50)	0	User defined Details in form 3
2	Active type	(0-1)	0	Same as above
3	Active range	(0-3)	2	0:after safety on delay 1:cranking 2:always active 3:inactive
4	Active actions	(0-4)	0	0:warning 1:warning and shutdown; 2:trip and shutdown 3:trip and not shutdown 4:instruction only
5	Active delay	(0-20.0)S	2.0	Time from detecting input port active to confirm
6	Description			Same as above
Programmable input port 5				
1	Contents setting	(0-50)	0	User defined Details in form 3
2	Active type	(0-1)	0	Same as above

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No.	Items	Parameters	Defaults	Description
3	Active range	(0-3)	2	Same as above
4	Active actions	(0-4)	1	Same as above
5	Active delay	(0-20.0)S	2.0	Same as above
6	Description			Same as above
Programmable input port 6				
1	Contents setting	(0-50)	0	User defined Details in form 3
2	Active type	(0-1)	0	Same as above
3	Active range	(0-3)	2	Same as above
4	Active actions	(0-4)	2	Same as above
5	Active delay	(0-20.0)S	2.0	Same as above
6	Description			Same as above
Programmable input port 7				
1	Contents setting	(0-50)	5	Lights testing Details in form 3
2	Active type	(0-1)	0	Same as above
Programmable output ports				
Programmable output port 1				
1	Contents setting	(0-239)	1	User defined period output (default is output in preheating) Details in Form 4
2	Active type	(0-1)	0	0:normally open; 1:normally close
Programmable output port 2				
1	Contents setting	(0-239)	35	Idle control output Details in Form 4
2	Active type	(0-1)	0	Same as above
Programmable output port 3				
1	Contents setting	(0-239)	29	Close gens output Details in Form 4
2	Active type	(0-1)	0	Same as above
Programmable output port 4				
1	Contents setting	(0-239)	31	Close mains output Details in Form 4
2	Active type	(0-1)	0	Same as above
Programmable output port 5				
1	Contents setting	(0-239)	38	ETS hold Details in Form 4
2	Active type	(0-1)	0	Same as above
Programmable output port 6				
1	Contents setting	(0-239)	48	Common alarm. Details in Form 4

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No.	Items	Parameters	Defaults	Description
2	Active type	(0-1)	0	Same as above

8.2 Enable definition of programmable output ports form (form 2)

No.	Type	Functions description
0	Not used	
1	Custom Period 1 output	Details of function description, please see following.
2	Custom Period 2 output	
3	Custom Period 3 output	
4	Custom Period 4 output	
5	Custom Period 5 output	
6	Custom Period 6 output	
7	Custom Combined 1	
8	Custom Combined 2	
9	Custom Combined 3	
10	Custom Combined 4	
11	Custom Combined 5	
12	Custom Combined 6	
13	Reserved	
14	Reserved	
15	Reserved	
16	Reserved	
17	Air flap	Actions in over speed alarm stop and emergence stop. It also can close the air inflow the engine.
18	Audible Alarm	Actions in warning, shutdown, trips. Can be connected outside alarm. When programmable input port is active of “alarm mute”, can prohibit its output.
19	Louver Control	Actions after genset start and breaker when genset stopped completely.
20	Fuel Pump Control	It is controlled by fuel pump of level sensor’s setting bound.
21	Heater Control	It is controlled by heating of temperature sensor’s setting bound.
22	Cooler Control	It is controlled by cooler of temperature sensor’s setting bound.
23	Pre-oil supply output	Actions from “crank on” to “safety on”.
24	Excite Generator	Output in start period. If there is no gens frequency during hi-speed running, output 2 seconds again.
25	Pre-lubricate	Actions in period of pre-heating to

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		safety-running.
26	Remote PC Output	This port is controlled by communication (PC).
27	GSM Power	Power for GSM module (GSM module is power-off reset when GSM communication failed).
28	Reserved	
29	Close Generator	Control switch of gens is load.
30	Open Breaker	Control switch is uninstalling.
31	Close Mains	Control switch of mains is load.
32	Reserved	
33	Crank Relay	
34	Fuel Relay	Actions in genset is starting and brokering when shutdown completely.
35	Idle Control	Use for engine which has idles. Pull in before starting and pull out after into hi-speed warming. Pull in when stopping idle mode and pull out after shutdown completely.
36	Raise Speed	Actions in hi-speed warming run.
37	Drop Speed	Actions in period of stop idle mode to time of wait for stopping completely.
38	ETS Control	Use for engine which has ETS electromagnet. Pull in when stop idle is over and pull out when set “ETS delay” is over.
39	Reserved	
40	ECU stop	Use for ECU engine and control its stop.
41	ECU power	Use for ECU engine and power control its power on.
42	Reserved	
43	Crank Success	Pull in when detected a successful start signal.
44	Generator OK	Actions in gens are normal.
45	Generator Available	Actions in period of gens OK to hi-speed cooling.
46	Mains OK	Action in mains is normal.
47	Reserved	
48	Common Alarm	Actions in gens common warning, common shutdown, common trips alarm.
49	Common Ele Trip	Actions in common trips shutdown alarm.
50	Common Shutdown	Actions in common shutdown alarm.
51	Common Trip Alarm	Actions in common trips and not shutdown alarm.
52	Common Warn Alarm	Actions in common warning alarm.

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53	Reserved	
54	Battery High Volts	An action in battery's over voltage warning alarm.
55	Battery Low Volts	Actions in battery's low voltage warning alarm.
56	Charge Alt Fail	Actions in charge Alt fail warning alarm.
57	Reserved	
58	Reserved	
59	Reserved	
60	ECU Warn	Indicate ECU sends a warning alarm signal.
61	ECU Shutdown	Indicate ECU sends a shutdown alarm signal.
62	ECU Com Fail	Indicate controller not communicates with ECU.
63	Reserved	
64	Reserved	
65	Reserved	
66	Reserved	
67	Reserved	
68	Reserved	
69	Aux Input 1 Active	Actions in input port 1 is active
70	Aux Input 2 Active	Actions in input port 2 is active
71	Aux Input 3 Active	Actions in input port 3 is active
72	Aux Input 4 Active	Actions in input port 4 is active
73	Aux Input 5 Active	Actions in input port 5 is active
74	Aux Input 6 Active	Actions in input port 6 is active
75	Aux Input 7 Active	Actions in input port 7 is active
76-98	Reserved	
99	Emergency Stop	Actions in emergency stop alarm.
100	Failed To Start	Actions in failed start alarm.
101	Failed To stop	Actions in failed stop.
102	Under Speed Warn	Actions in under speed warning.
103	Under Speed Shutdown	Actions in under speed shutdown.
104	Over Speed Warn	Actions in over speed warning.
105	Over Speed Shutdown	Actions in over speed shutdown alarm.
106	Reserved	
107	Reserved	
108	Reserved	
109	Gens OF Warn	Actions in gens over frequency warning.
110	Gens OF Shutdown	Actions in gens over frequency shutdown alarm.
111	Gens OV Warn	Actions in gens over voltage warning.
112	Gens OV Shutdown	Actions in gens over voltage shutdown.

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113	Gens LF Warn	Actions in gens low frequency warning.
114	Gens LF Shutdown	Actions in gens low frequency shutdown.
115	Gens LV Warn	Actions in gens low voltage warning.
116	Gens LV Shutdown	Actions in gens low voltage shutdown.
117	Gens Loss Of Phase	Actions in gens loss phase.
118	Gens Reverse Phase	Actions in gens reverse phase.
119	Reserved	
120	Over Power	
121	Reserved	
122	Reverse Power	Actions in controller detected gens have reverse power.
123	Over Current	Actions in over current.
124	Reserved	
125	Mains Inactive	
126	Mains Over Freq	
127	Mains Over Volt	
128	Mains Under Freq	
129	Mains Under Volt	
130	Mains Reverse Phase	
131	Mains Loss Phase	
132-138	Reserved	
139	High Temp Warn	Actions in hi-temperature warning alarm.
140	Low Temp Warn	Actions in low temperature warning alarm.
141	High Temp Shutdown	Actions in hi-temp. Shutdown alarm.
142	Reserved	
143	Low OP Warn	Actions in low oil pressure warning alarm.
144	Low OP Shutdown	Actions in low oil pressure shutdown.
145	OP Sensor Open	Actions in oil pressure sensor are open circuit.
146	Reserved	
147	Low Level Warn	Actions when controller has low oil level alarm.
148	Reserved	
149	Reserved	
150	Config1 high Warn	
151	Config1 Low Warn	
152	Config1 high Shut	
153	Config1 Low Shut	
154	Config2 high Warn	
155	Config2 Low Warn	
156	Config2 high Shut	
157	Config2 Low Shut	
158-	Reserved	

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229		
230	In Stop Mode	Actions in stop mode.
231	In Manual Mode	Actions in manual mode.
232	In Test Mode	Actions in manual test mode.
233	In Auto Mode	Actions in auto mode.
234	Generator On Load	
235	Mains On Load	
236	Reserved	
237	Reserved	
238	Reserved	
239	Reserved	

8.2.1 Defined Period output

Defined Period output is made of 2 parts, period output S1 and condition output S2.

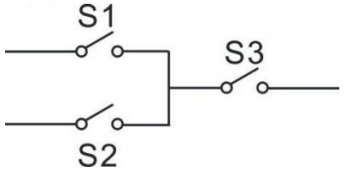
While S1 and S2 are TRUE synchronously, OUTPUT;
While S1 or S2 is FALSE, NOT OUTPUT.
Period output S1, can set generator's one or more period output freely, can set the delayed time and output time after into period.
Condition output S2; can set as any conditions in output ports.

Note, when delayed time and output time both are 0 in Period output S1, it is TRUE in period of programmable.

Example,
Period output: start
Delay output time: 2s
Output time, 3s
Condition output contents, output port 1 is active
Close when condition output active/inactive, close when active (disconnect when inactive);
Output port 1 active, after enter "starts time" and delay 2s, this Defined Period output is outputting, after 3s, stop outputting;
Output port 1 inactive, defined Period output is not outputting.

8.2.2 Defined combination output

Defined combination output is made of 3 parts, output = (S1 or S2) and S3.



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S1 or S2 is TRUE, while S3 is TRUE, Defined combination output is outputting;
S1 and S2 are FALSE, or S3 is FALSE, Defined combination output is not outputting.

⚠ Note, S1, S2, S3 can be set as any contents except for “Defined combination output” in the output setting.

⚠ Note, 3 parts of Defined combination output (S1, S2, S3) couldn’t including or recursion including themselves.

Example,

Contents of probably condition output S1, output port 1 is active;

Close when probably condition output S1 is active/inactive, close when active (disconnect when inactive);

Contents of probably condition output S2, output port 2 is active;

Close when probably condition output S2 is active/inactive, close when active (disconnect when inactive);

Contents of probably condition output S3, output port 3 is active;

Close when probably condition output S3 is active/inactive, close when active (disconnect when inactive);

When input port 1 active or input port 2 active, if input port 3 is active, Defined combination output is outputting; If input port 3 inactive, Defined combination output is not outputting;

When input port 1 inactive and input port 2 inactive, whatever input port 3 is active or not, Defined combination output is not outputting.

8.3 Defined contents of programmable input ports form (All is active when connect grand (B-)) (Form 3)

No.	Type	Function description
0	Customer defined	Including below functions, Indicator, indicate only, not warning and not shutdown. Warning, warning only, not shutdown. Shutdown, alarm and shutdown immediately Trip and shutdown, alarm, generator uninstalls shutdown after hi-speed cooling trip and not shutdown, alarm, generator uninstalls, not shutdown.

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		Inactive, no work of input. All the time active, input is active all the time. Start active, detecting as soon as start. Safety running active, detecting after safety running delay
1	Reserved	
2	Alarm Mute	Can prohibit output of “Audible Alarm” when is active
3	Reset Alarm	Can reset shutdown alarm and trip alarm when is active
4	60Hz Select	Use for CANBUS engine and it is 60HZ when is active.
5	Lamp Test	All LED indicators are light when input is active.
6	Panel Lock	All buttons in panel is no work except and there is in the left of first row in LCD when input is active.
7	Reserved	
8	Slow Control Mode	Protection less voltage, frequency and speed is inactive.
9	Inhibit Auto Stop	In auto mode, when input is active, prohibit gens shutdown auto after gens is OK.
10	Inhibit Auto Start	In auto mode, prohibit gens start auto when input is active.
11	Inhibit Scheduled	In auto mode, prohibit fixed timing start genset when input is active.
12	Reserved	
13	Aux Gens Closed	Connect gens loading switch’s Aux. point.
14	Inhibit Gens Load	Prohibit genset switch on when input is active.
15	Aux Mains Closed	Connect mains loading switch’s Aux. point.
16	Inhibit Mains Load	Prohibit mains switch on when input is active.
17	Reserved	
18	Reserved	
19	Reserved	
20	Reserved	
21	Inhibit Alarm Stop	All shutdown alarms are prohibited except emergence stop.(Means battle mode or over control mode)
22	Aux Instrument Mode	All outputs are prohibited in this mode.
23	Reserved	
24	Reset Maintenance	Controller will set maintenance time and date as default when input is active.

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25	Reserved	
26	Aux High Temp	
27	Aux Low OP	
28	Remote Start On Load	In auto mode, when input is active, genset can be started auto and with load after genset is OK; when input is inactive, genset can be shutdown auto.
29	Remote Start Off Load	In auto mode, when input is active, genset can be started auto and without load after genset is OK; when input is inactive, genset can be shutdown auto.
30	Aux Manual Start	In auto mode, when input is active, genset can be started auto; when input is inactive, genset can be shutdown auto.
31	Reserved	
32	Reserved	
33	Simulate Stop key	An outside button can be connected and pressed as simulate panel.
34	Simulate Manual key	
35	Simulate Test key	
36	Simulate Auto key	
37	Simulate Start key	
38	Simulate G-Load key	
39	Simulate M-Load Key	
40	Reserved	
41	Reserved	
42	Reserved	
43	Reserved	
44	Reserved	
45	Aux Mains OK	In auto mode, mains are normal when input is active.
46	Aux Mains Fail	In auto mode, mains are abnormal when input is active.
47	Reserved	
48	Reserved	
49	Reserved	
50	Reserved	

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8.4 Selection of sensors (form 4)

No.		Description	Remark
1	Temperature sensor	0 not used 1 defined resistance curve 2 defined 4-20mA curve 3 VDO 4 CURTIS 5 VOLVO-EC 6 DATCON 7 SGX 8 SGD 9 SGH 10 PT100 11-15 reserved	Defined resistance's scope is 0~6KΩ, default is SGX kind sensor.
2	Pressure sensor	0 not used 1 defined resistance curve 2 defined 4-20mA curve 3 VDO 10Bar 4 CURTIS 5 VOLVO-EC 6 DATCON 10Bar 7 SGX 8 SGD 9 SGH 10-15 reserved	Defined resistance's scope is 0~6KΩ, default is SGX kind sensor.
3	Oil level sensor	0 not used 1 defined resistance curve 2 defined 4-20mA curve 3 SGD 4 SGH 5-15 reserved	Defined resistance's scope is 0~6KΩ, default is SGH kind sensor.

Note, user should make special declare when order controller if your genset equip for sensor of 4-20mA.

8.5 Conditions of start successfully selection

No.	Setting description
0	Gens frequency
1	Speed sensor
2	Speed sensor + Gens frequency
3	Oil pressure
4	Oil pressure + Gens frequency

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5	Oil pressure + Speed sensor
6	Oil pressure + Speed sensor + Gens frequency

⚠ Note,

1. There are 3 conditions to make starter disconnected with engine, magnetic sensor, gens frequency and engine oil pressure. They all can be used separately. We recommend that if apply for starting by engine oil pressure, should plus using of magnetic sensor and gens frequency together, in order to make the starter motor is separated with engine immediately and can check start successful or not exactly.
2. Magnetic sensor, is the magnetic equipment which be installed in starter and for detecting tooth of flywheel.
3. When start is set as magnetic sensor, must ensure that the tooth no. of flywheel is as same as setting, otherwise, “over speed stop” or “under speed stop” maybe caused.
4. If genset without Magnetic sensor, please don’t select items correspond, otherwise, “stop fail” or “loss speed signal and alarming” maybe caused.
5. If genset without oil pressure sensor, please don’t select items correspond.
6. If no select of gens in start successful setting, controller will not collect and display the relative power quantity (can be used in water pump set); if no select of Magnetic sensor in start successful setting, the rotate speed displayed in controller is converted calculate on gens frequency and number of poles.

9 Parameters setting

In HGM7x10 series controller, there are no items of mains in setting and also no mains items in configurable ports of input/output.

⚠Careful, please change the controller parameters when generator is stand by only (e. g. Start conditions selection, configurable input, programmable output, various delay), otherwise, alarming to stop and other abnormal maybe caused.

⚠ Note, overtop threshold value must greater than over-low threshold value; otherwise, there is situation that overtop as well as over-low.

⚠ Note, when setting the warning alarm, please set the correct return value; otherwise, maybe there is abnormal alarm. When setting the overtop warning, the

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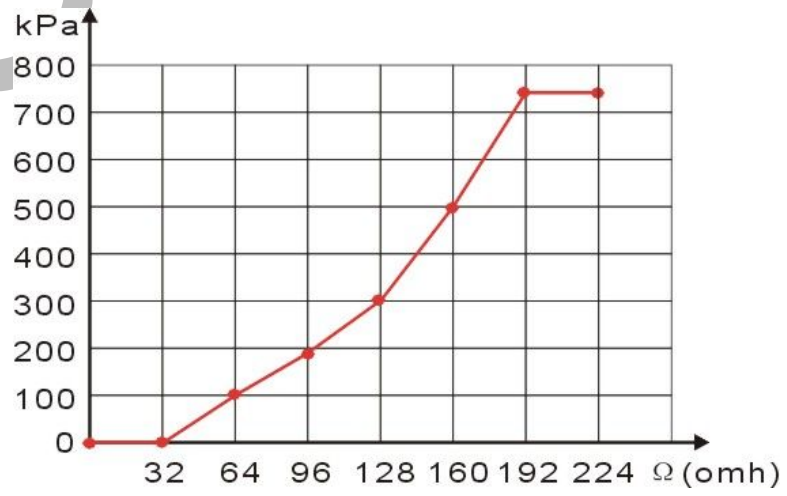
return value must less than setting; When setting the over-low warning, the return value must greater than setting.

⚠ Note, please set the generator frequency value as low as possible when start successful, in order to make the starter be separated quickly as soon as start successfully.

⚠ Note, configurable input couldn't be set as same items; otherwise, there are abnormal functions. But the configurable output can be set as same items.

10 Sensors setting

1. When reselect sensors, the sensor curve will be transferred into the stand value. For example, if temperature sensor is SGX (120°C resistor type), its sensor curve is SGX (120°C resistor type); if select the SGD (120°C resistor type), the temperature sensor curve is SGD curve.
2. When there is difference between standard sensor curves and using sensor, user can adjust it in "curve type input".
3. When input the sensor curve, X value (resistor) must be input from small to large, otherwise, there is mistake.
4. If don't select sensor, sensor curve is not working.
5. If corresponding sensor has alarm switch only, user must set this sensor as "NO", otherwise, maybe there is alarming stop or warning.
6. The headmost or backmost values in the vertical coordinates can be set as same, like the under.



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Normal Pressure Unit Conversion Form

	N/m^2 (pa)	(kgf/cm^2)	(bar)	($1b/in^2$.psi)
1Pa	1	$1.02x10^{-5}$	$1x10^{-5}$	$1.45x10^{-4}$
$1kgf/cm^2$	$9.8x10^4$	1	0.98	14.2
1bar	$1x10^5$	1.02	1	14.5
1psi	$6.89x10^3$	$7.03x10^{-2}$	$6.89x10^{-2}$	1

11 Commissioning

Please make the under procedures checking before commissioning,

1. Check all the connections are correct and wires diameter is suitable.
2. Ensure that the controller DC power has insurance, controller‘s positive and negative connected to start battery are correct.
3. Scram button’s normal close point is connected with input of emergence stop, and insurance must be connected with positive and negative of start battery.
4. Take proper actions to prevent engine to start successfully (e. g. Remove the connection wire of fuel value). If checking is OK, make the start battery power on; choose manual mode and controller will executive routine.
5. Set controller under manual mode, press “start” button, genset will start. After the setting times as setting, controller will send signal of Start Fail; then press “stop” to make controller as reset.
6. Recover the action of stop engine start (e. g. Connect wire of fuel value), press start button again, genset will start. If everything goes well, genset will normal run after idle running (if idle run be set). During this time, please watch for engine’s running situations and AC generator’s voltage and frequency. If abnormal, stop genset running and check all wires connection according to this manual.
7. Select the AUTO mode from controller‘s panel, connect mains signal. After the mains normal delay, controller will transfer ATS (if have) and into mains load. After cooling time, controller will stop genset and make it in to stand by time until there is abnormal of mains.
8. When mains is abnormal again, genset will be started auto and into normal running, then controller send signal to make gens switch on, and control the ATS as gens load. If not like this, please check ATS’ wires connection of control part according to this manual.
9. If have any other questions, please contact Smartgen’s service.

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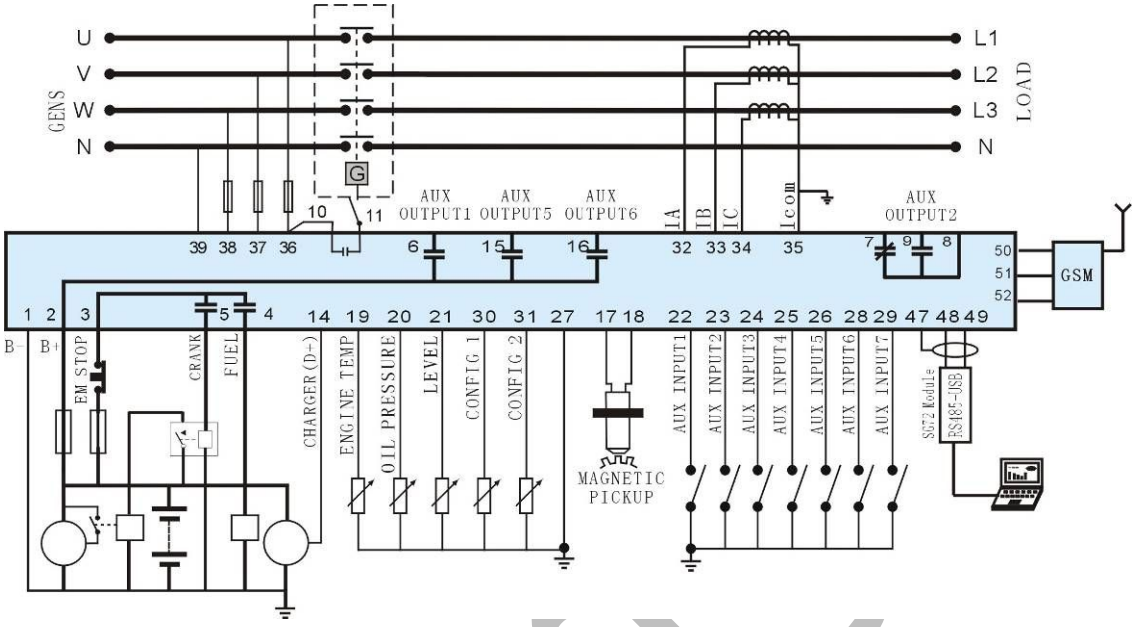
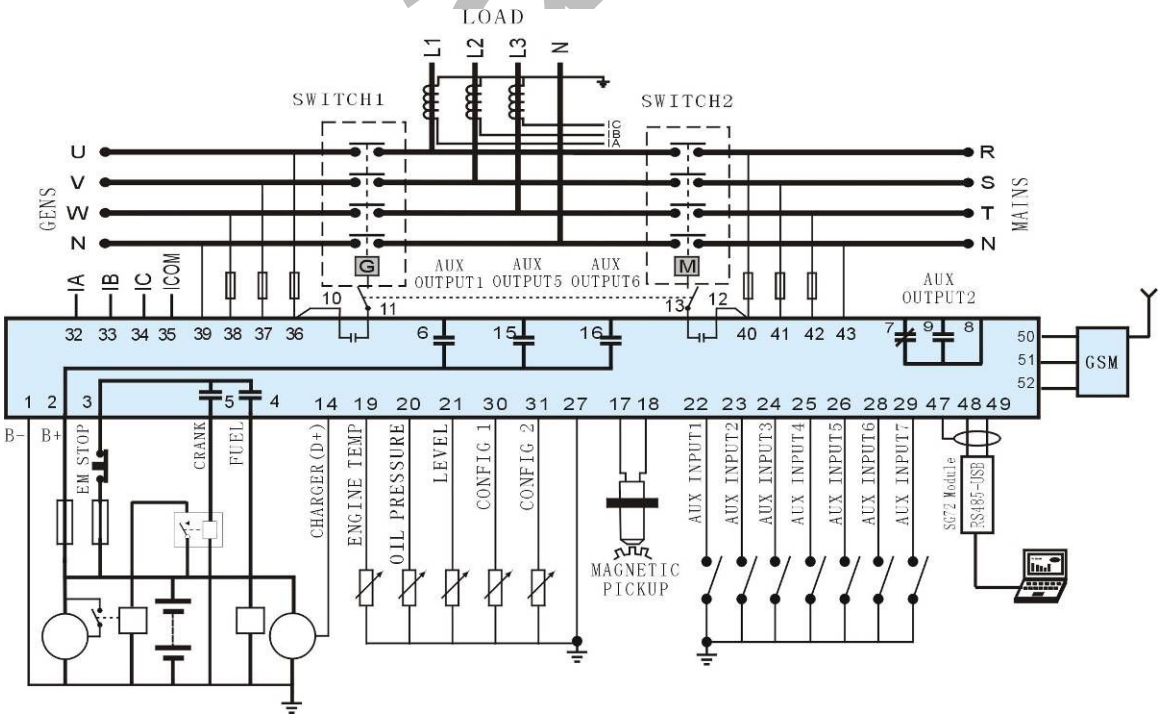
12 Typical application

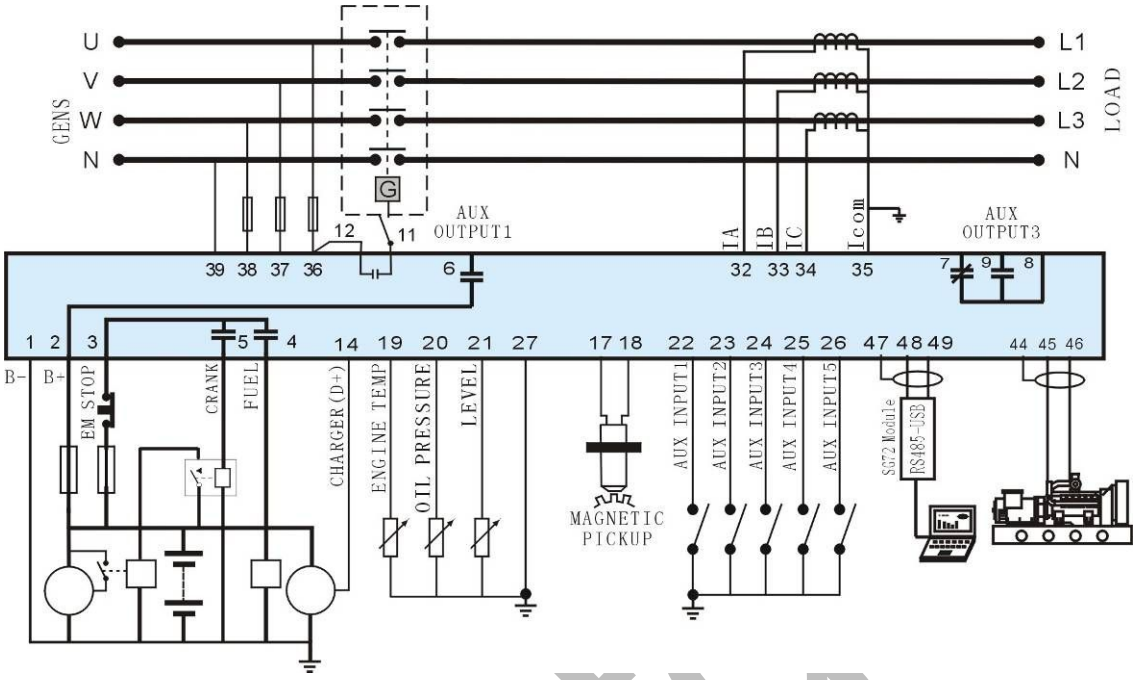
HGM7210 typical application diagram



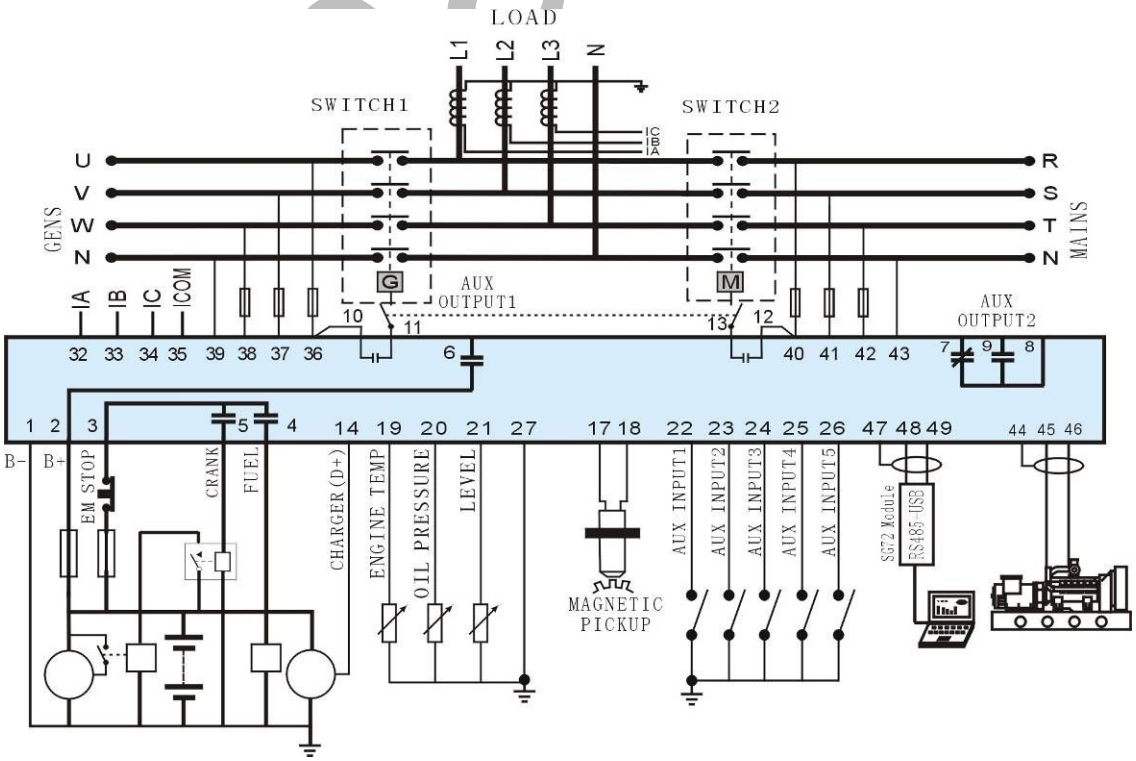
HGM7220 typical application diagram



HGM7110CAN typical application diagram

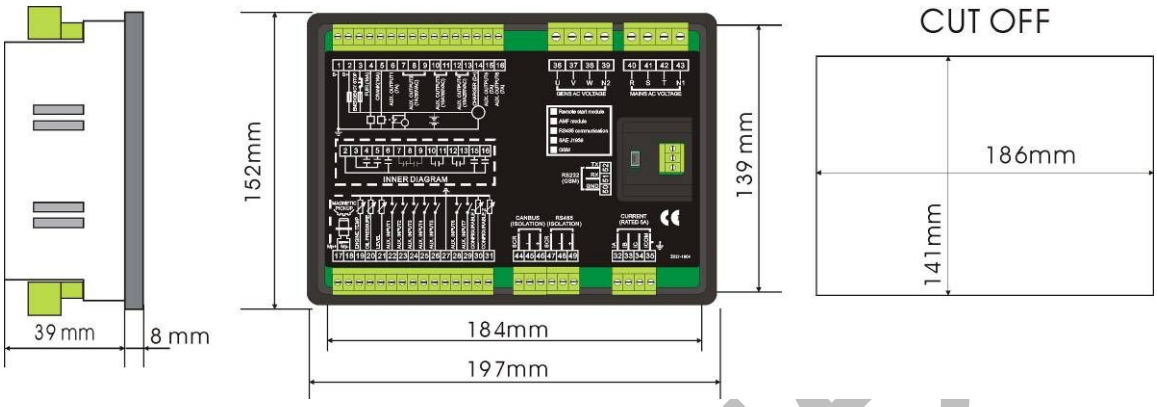


HGM7120CAN typical application diagram



13 Installation

Controller is panel built-in design; it is fixed by clips when installed. The controller's overall dimensions and cutoff dimensions for panel, please refers to as following,



1) Input of battery voltage

Note, HGM7200/7100 series controller can suit for widely range of battery voltage (8~35VDC). Negative of battery must connect with the shell of starter stable. The wire's diameter must over 2.5mm^2 and which is connected to B+ and B- of controller power. If have floating charger, please firstly connect output wires of charger to battery's positive and negative directly, then, connect wires from battery's positive and negative to controller's positive and negative input ports, in order to prevent charge disturbing the controller's normal working.

2) Input of speed sensor

Note, speed sensor, is the magnetic equipment which be installed in starter and for detecting tooth of flywheel. Its connection wires to controller should apply for 2 cores shielding line. The shielding layer should connect with No. 18 terminal in controller while another side is hanging in air. The else two signal wires are connected with No.17 and No.18 terminals in controller. The output voltage of speed sensor should be within 1~24VAC (effective value) during the full speed. 12VAC is recommended (in rated speed). When install the speed sensor, let the sensor is spun to contacting flywheel first, then, port out 1/3 lap, and lock the nuts of sensor at last.

3) Output and expand relays

Careful, all outputs of controller are relay contact output type. If need to expand the relays, please add freewheel diode to both ends of expand relay's coils (when coils of relay has DC current) or, increase resistance-capacitance return circuit (when coils of relay has AC current), in order to prevent disturbance

to controller or others equipment.

4) AC input

Current input of controller must be connected to outside current transformer. And the current transformer's secondary side current must be 5A. At the same time, the phases of current transformer and input voltage must correct. Otherwise, the current of collecting and active power maybe not correct.

⚠ Note: COM port must be connected to negative pole of battery controller power.

Warning, when there is load current, transformer's secondary side prohibit from open circuit.

5) Pressurization test

⚠Careful, when controller had been installed in control panel, if need the Pressurization test, please disconnect controller's all terminal connections, in order to prevent High pressure into controller and damage it.

14 GSM short message alarm and remote control

14.1 GSM short message alarm

When controller detected alarm, it will send short message to phone number which be set automatic.

⚠ Note. All alarms about stop, trip stop and trip not stop; will be sending to the set phone number. Warning alarms are selected according to set to be sent to the phone number.

14.2 GSM short message remote control

Users send order message to GSM mode, then, controller will make actions according to this SMS order and re-back operations information. Controllers only do the orders by set. Detail orders as following:

No.	SMS orders	Re-back information	Description	
1	SMS GENSET	GENSET ALARM	When	Gets

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			genset is stopping to alarm	status of genset
		SYSTEM IN STOP MODE GENSET AT standby	Standby in stop mode	
		SYSTEM IN MANUAL MODE GENSET AT REST	Standby in manual mode	
		SYSTEM IN TEST MODE GENSET AT REST	Standby in trial test mode	
		SYSTEM IN AUTO MODE GENSET AT REST	Standby in Auto mode	
		SYSTEM IN STOP MODE GENSET IS RUNNING	Start status in stop mode	
		SYSTEM IN MANUAL MODE GENSET IS RUNNING	Start status in manual mode	
		SYSTEM IN TEST MODE GENSET IS RUNNING	Start status in trial test mode	
		SYSTEM IN AUTO MODE GENSET AT RUNNING	Start status in Auto mode	
2	SMS START	GENSET ALARM	Genset is stop to alarm or trip alarm	Start genset
		STOP MODE NOT START	Cannot start in stop mode	
		SMS START OK	Start in manual or auto mode	
		AUTO MODE NOT START	Cannot start in auto mode	
3	SMS STOP MODE	SMS STOP OK	Set as stop mode	
4	SMS MANUAL MODE	SMS MANUAL MODE OK	Set as manual mode	
5	SMS TEST MODE	SMS TEST MODE OK	Set as trial test mode	
6	SMS AUTO MODE	SMS AUTO MODE OK	Set as auto mode	
7	SMS DETAIL	Re-back information can be set via controller	Gets details information of genset.	

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		software.	

⚠ Note, when sending orders, user need to follow SMS orders in above form and all the letters must be capital.

⚠ Note, details information of re-back including, working mode, mains voltage, gens voltage, load current, mains frequency, gens frequency, active power, apparent power, power factor, battery voltage, D+ voltage, water temperature, oil pressure, oil level, rotate speed, total running time, genset status, and alarm status.

15 Connections of controller with J1939 engine

15.1 CUMMINS ISB/ISBE

Terminals of controller	Connector B	Remark
Fuel fuel relay output	39	
Start relay output	-	Connect to starter coil directly
Configurable output port 1	Expand 30A relay, battery voltage of 01,07,12,13 is supplied by relay	ECU power Set configurable output 1 as "ECU power"

Terminals of controller	Cummins ISB 9 pin Deutsch Connector	Remark
CAN GND	SAE J1939 shield	Screen for the J1939 cable. Connect at Cummins ECU end only.
CAN(H)	SAE J1939 signal	J1939 + Use only screened 120 impedance cables approved specifically for use in CANbus applications.
CAN(L)	SAE J1939 return	J1939 - Use only screened 120 impedance cables approved specifically for use in CANbus applications.

Engine type, Cummins ISB

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15.2 CUMMINS QSL9

Suitable for CM850 engine control mode

Terminals of controller	50 pins connector	Remark
Fuel fuel relay output	39	
Start relay output	-	Connect to starter coil directly

Controller terminals	9 pins connector	Remark
CAN GND	SAE J1939 shield-E	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	SAE J1939 signal-C	Using impedance 120Ω connecting line
CAN(L)	SAE J1939 return-D	Using impedance 120Ω connecting line

Engine type, Cummins-CM850

15.3 CUMMINS QSM11

Suitable for CM570 engine control mode. Type of engine is QSM11 G1, QSM11 G2.

Terminals of controller	C1 connector	Remark
Fuel relay output	5&8	Outside expand relay, when oil output, using make port 5 and port 8 of C1 be connected
Start relay output	-	Connect to starter coil directly

Terminals of controller	3 pins data link connector	Remark
CAN GND	C	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	A	Using impedance 120Ω connecting line
CAN(L)	B	Using impedance 120Ω connecting line

Engine type, Cummins ISB

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15.4 CUMMINS QSX15-CM570

Suitable for CM570 engine control mode. Type of engine is QSX15 ext.

Terminals of controller	50 pins connector	Remark
Fuel fuel relay output	38	Oil injection switch
Start relay output	-	Connect to starter coil directly

Terminals of controller	9 pins connector	Remark
CAN GND	SAE J1939 shield-E	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	SAE J1939 signal-C	Using impedance 120Ω connecting line
CAN(L)	SAE J1939 return-D	Using impedance 120Ω connecting line

Engine type, Cummins QSX15-CM570

15.5 CUMMINS GCS-MODBUS

Suitable for GCS engine control mode. Use RS485-MODBUS to read information of engine. Type of engine is QSX15, QST30, QSK23/45/60/78 ext.

Terminals of controller	D-SUB connector 06	Remark
Fuel relay output	5&8	Outside expand relay, when oil output, connect port 06 and08 of the connector
Start relay output	-	Connect to starter coil directly

Terminals of controller	D-SUB connector 06	Remark
RS485 GND	20	CAN communication shielding line(connect in ECU this terminal only)
RS485+	21	Using impedance 120Ω connecting line
RS485-	18	Using impedance 120Ω connecting line

Engine type, Cummins QSK-MODBUS, Cummins QST-MODBUS, Cummins

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QSX-MODBUS

15.6 DETROIT DIESEL DDEC III / IV

Terminals of controller	CAN port of engine	Remark
Fuel relay output	Expand 30A relay, battery voltage of 01,07,12,13 is supplied by relay	
Start relay output	-	Connect to starter coil directly
CAN GND	-	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	CAN(H)	Using impedance 120Ω connecting line
CAN(L)	CAN(L)	Using impedance 120Ω connecting line

Engine type, J1939 common used.

15.7 DEUTZ EMR2

Terminals of controller	F connector	Remark
Fuel relay output	Expand 30A relay, battery voltage of 01,07,12,13 is supplied by relay. Fuse is 16A	
Start relay output	-	Connect to starter coil directly
-	1	Connect to battery negative pole
CAN GND	-	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	12	Using impedance 120Ω connecting line
CAN(L)	13	Using impedance 120Ω connecting line

Engine type, VolvoEDC4

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15.8 JOHN DEERE

Terminals of controller	21 pins connector	Remark
Fuel relay output	G,J	
Start relay output	D	
CAN GND	-	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	V	Using impedance 120Ω connecting line
CAN(L)	U	Using impedance 120Ω connecting line

Engine type, john Deere

15.9 MTU MDEC

Suitable for MTU engines, 2000 series, 4000series

Terminals of controller	X1 connector	Remark
Fuel relay output	BE1	
Start relay output	BE9	
CAN GND	E	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	G	Using impedance 120Ω connecting line
CAN(L)	F	Using impedance 120Ω connecting line

Engine type, mtu-MDEC-303

15.10 PERKINS

Suitable for ADEM3/ ADEM4 engine control mode. Engine type is 2306, 2506, 1106, and 2806.

Terminals of controller	Connector	Remark
Fuel relay output	1,10,15,33,34	
Start relay output	-	Connect to starter coil directly
CAN GND	-	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	31	Using impedance 120Ω connecting line

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CAN(L)	32	Using impedance 120Ω connecting line

Engine type, Perkins

15.11 SCANIA

Suitable for S6 engine control mode. Engine type is DC9, DC12, and DC16.

Terminals of controller	B1 connector	Remark
Fuel relay output	3	
Start relay output	-	Connect to starter coil directly
CAN GND	-	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	9	Using impedance 120Ω connecting line
CAN(L)	10	Using impedance 120Ω connecting line

Engine type, Scania

15.12 VOLVO EDC3

Suitable for TAD1240, TAD1241, TAD1242 engine control mode.

Terminals of controller	“Stand alone” connector	Remark
Fuel relay output	H	
Start relay output	E	
Configurable output 1	P	ECU power Configurable output 1,”ECU power”

Terminals of controller	“Data bus” connector	Remark
CAN GND	-	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	1	Using impedance 120Ω connecting line
CAN(L)	2	Using impedance 120Ω connecting line

Engine type, Volvo

Note, when select this engine type, the preheat time should be set more

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than 3 seconds.

15.13 VOLVO EDC4

Engine type is TD520, TAD520 (optional), TD720, TAD720 (optional), TAD721, TAD722, and TAD732.

Terminals of controller	Connector	Remark
Fuel relay output	Expanded 30A relay, and relay offers battery voltage to terminal 1.Fuse is 16A	
Start relay output	-	Connect to starter coil directly
	1	Connected to negative of battery
CAN GND	-	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	12	Using impedance 120Ω connecting line
CAN(L)	13	Using impedance 120Ω connecting line

Engine type, VolvoEDC4

15.14 VOLVO-EMS2

Volvo Engine type is TAD734, TAD940, TAD941, TAD1640, TAD1641, and TAD1642.

Terminals of controller	Engine's CAN port	Remark
Configurable output 1	6	ECU stop Configurable output 1 "ECU stop"
Configurable output 2	5	ECU power Configurable output 2 "ECU power"
	3	Negative power
	4	Positive power
CAN GND	-	CAN communication shielding line(connect in ECU this terminal only)

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CAN(H)	1(Hi)	Using impedance 120Ω connecting line
CAN(L)	2(Lo)	Using impedance 120Ω connecting line

Engine type, Volvo-EMS2

Note, when select this engine type, the preheat time should be set more than 3 seconds.

15.15 BOSCH

Suitable for BOSCH common rail pump engine.

Terminals of controller	Engine 42 pins	Remark
Fuel relay output	1.40	Connect to engine ignition lock
Start relay output	-	Connect to starter coil directly
CAN GND	-	CAN communication shielding line(connect in ECU this terminal only)
CAN(H)	1.35	Using impedance 120Ω connecting line
CAN(L)	1.34	Using impedance 120Ω connecting line

Battery	Engine 2 pins	Remark
Battery negative	1	Wire diameter 2.5mm^2
Battery positive	2	Wire diameter 2.5mm^2

Engine type, BOSCH

Note, if there is any questions of connection between controller and ECU communication, please feel free to contact Smartgen service.

16 Common faults and solutions

Faults	Possible solutions
Controller no response with power.	Check starting batteries; Check controller connection wirings; Check DC fuse.
Genset shutdown	Check the water/cylinder temperature is high; Check the genset AC voltage; Check DC fuse.

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Controller emergency stop	Check emergence stop button is correct or not; Check whether the starting battery positive be connected to the emergency stop's input; Check whether the circuit is open.
Low oil pressure alarm after start successful	Check the oil pressure sensor and its connections.
High water temp. alarm after start successful	Check the temperature sensor and its connections.
Alarm shutdown in running	Check related switch and its connections according to the information on LCD; Check programmable inputs.
Starting not successful	Check fuel oil circuit and its connections; Check starting batteries; Check speed sensor and its connections; Refer to engine manual.
Starter no responds	Check starter connections; Check starting batteries.
Genset running while ATS not transfer	Check ATS; Check the connections between ATS and controllers.
RS485 communication is abnormal	Check connections; Check setting of COM port is correct or not; Check RS485's connections of A and B is reverse connect or not; Check whether damaged of RS485transfer model; Check whether damaged of communication port of PC.
ECU communication is failed	Check connections of CAN high and low polarity; Check if correct connected of 120Ω resister; Check if correct type of engine; Check if correct connections from controller to engine and if correct setting of inputs.
ECU warning or stop	Get information from LCD of alarm page; If there is detailed alarm, check engine according to description. If no, pls refer to engine manual according to SPN alarm code.

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